Routing Without Rumor: Securing the Internet's Routing System

Dr. Burt Kaliski, Sr. Vice President and CTO

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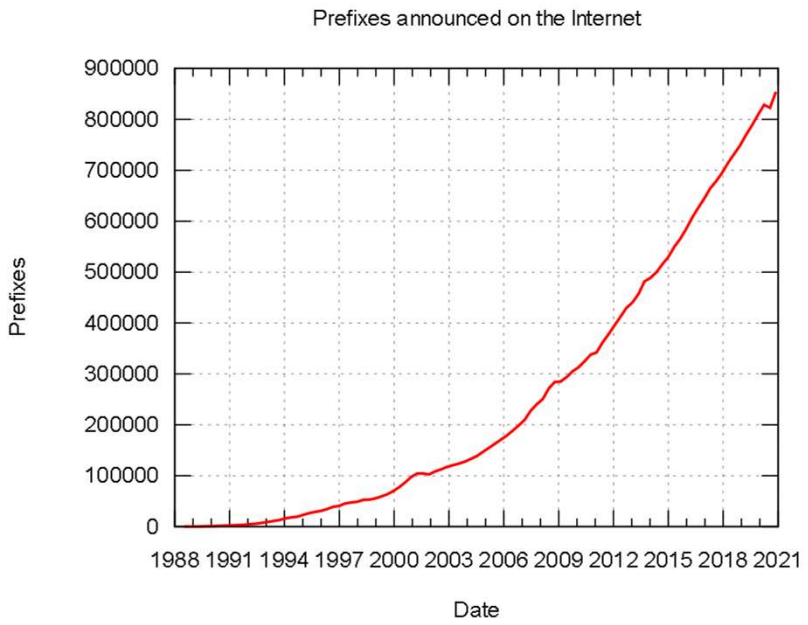
Routing by Rumor

- **Internet routing system** is fundamental to internet security, stability and resiliency
  - What are the available routes to internet destinations?
- Effective, robust, immense scale
- Decentralized, implicit trust model
- Networks share knowledge of routes with one another … they **route by rumor**

Border Gateway Protocol (BGP)

- **BGP** is the internet's routing protocol
  - RFC 1105 in 1989; RFC 4271 for v4 in 2006
- Networks route traffic based on local policy using shared knowledge of routing paths
- No central point of control — or failure



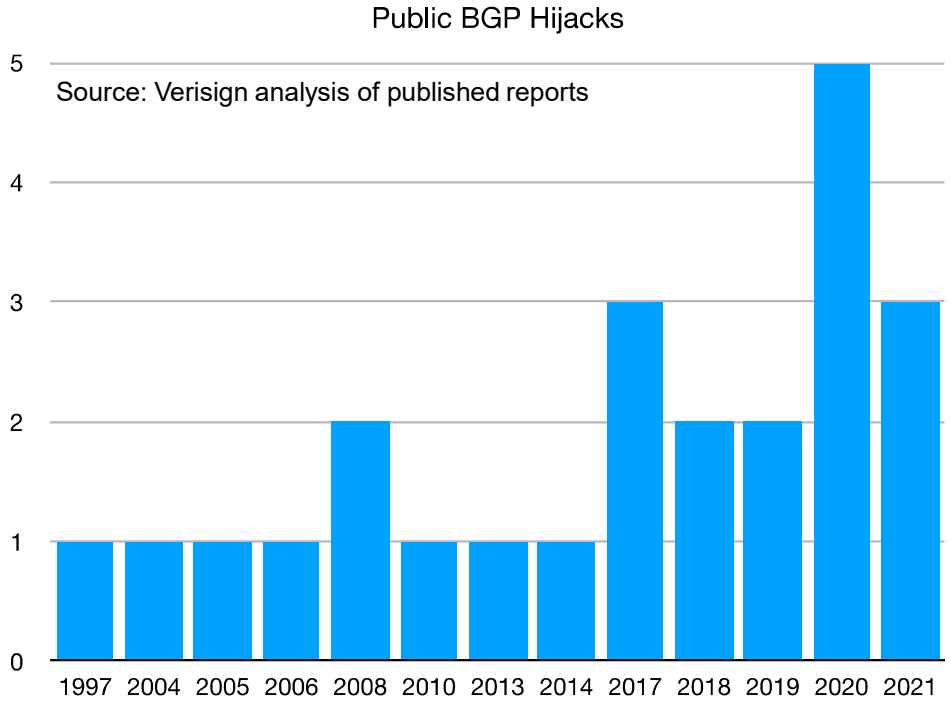
< 100,000 global routes in 2000

> 850,000 global routes in 2021

Source: Mro / Bombenleger, CC BY-SA 3.0

Route Hijacks and Leaks

- **Route hijacks** divert traffic to an *unintended destination*
- **Route leaks** draw traffic through an *unintended path*
- *Millions* of events reported; 15 *major* events since 2017
  - Average duration: 1h 57m



Resource Public Key Infrastructure (RPKI)

- **RPKI** enables networks to **validate route origins**
  - RPKI: RFCs 6480-6495 in 2012
- Centralized, explicit trust model for authorization information
- … but new critical dependencies

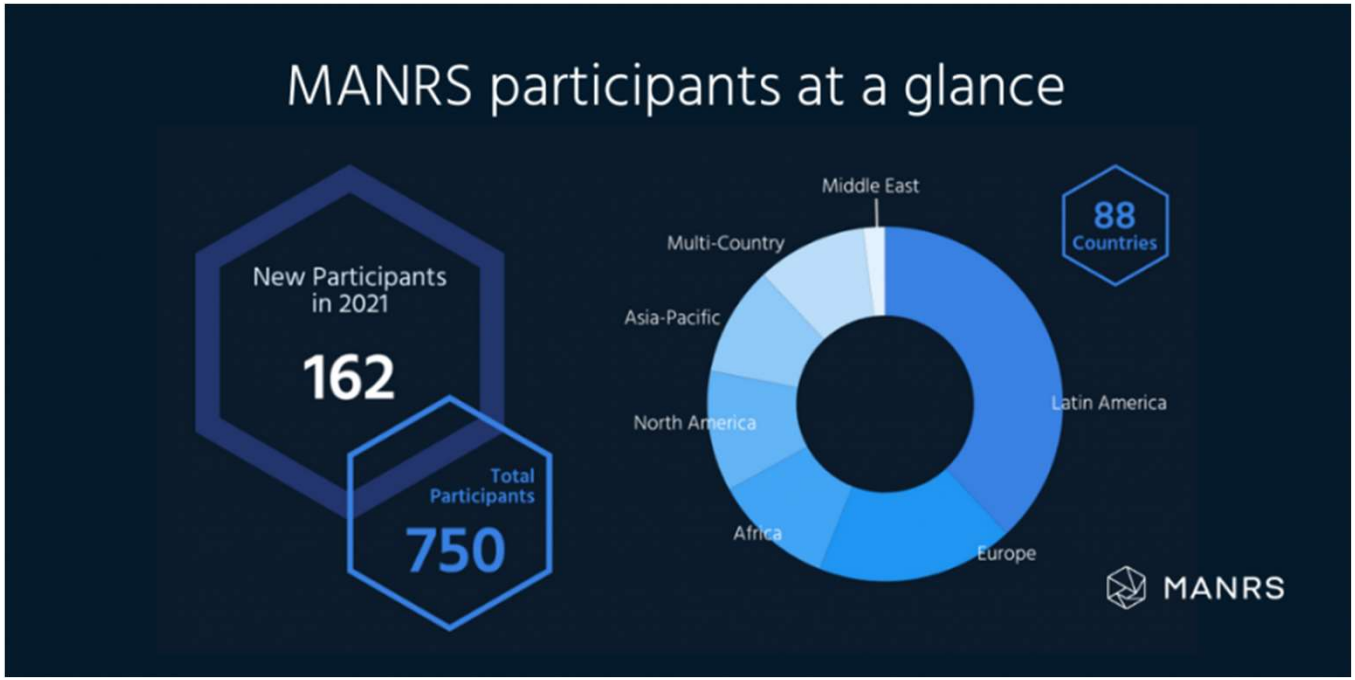
- Technical details …
  - Regional Internet Registries provide trust anchors, issue Route Origin Authorizations (ROA)
  - ROAs cryptographically associate IP address prefixes with network ASNs
  - Route Origin Validation occurs out-of-band
  - Next: Path validation (draft-ietf-sidrops-aspa-verification)

Mutually Agreed Norms for Routing Security (MANRS)

MANRS is a community-led initiative to improve routing security

Key techniques:

- Coordination
- Global Validation
- Anti-Spoofing
- Filtering



Source: https://www.manrs.org/isps/guide/

Source: MANRS.org

Routing without Rumor

- Routing by rumor has served the internet well while avoiding systemic dependencies
- Critical role of internet, evolving cyberthreat landscape require a better approach … including better "MANRS"
- RPKI offers a first step toward a new approach where networks *verify* routing information … and **route without rumor**

For more information, please see Danny McPherson's article, "Routing Without Rumor: Securing the Internet's Routing System" on Verisign's blog